Yellow Fever

September 2004

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Yellow fever is a mosquito-borne viral illness. It is caused by the yellow fever virus, which is in the genus *Flavivirus* and family *Flaviviridae*.

B. Clinical Description and Laboratory Diagnosis

Many cases of yellow fever are so mild they go undetected. In typical cases of recognized illness, the patient experiences a sudden onset of fever, chills, headache, backache, generalized muscle pain, prostration, nausea and vomiting. Jaundice, albuminuria (the presence of protein in the urine), and anuria (absence of urine) may occur. Most infections resolve at this stage. However, in more severe cases of illness, after a brief remission of hours to a day, there is progression to liver and kidney failure and to hemorrhagic symptoms, including nosebleeds, bleeding gums, bloody vomiting and bloody stools. Twenty to fifty percent of severe cases with jaundice are fatal. The overall case-fatality rate in endemic regions is about 5%. Lifetime immunity follows yellow fever recovery. Laboratory diagnosis is made by isolation of the virus from blood, by demonstration of viral antigen in the blood (by ELISA) or liver tissue (by immunohistochemistry), by demonstration of viral genome in blood and liver tissue (by PCR or hybrydization process), by demonstrating specific IgM in early sera, or a rise in titer of specific antibodies in paired acute and convalescent sera.

C. Reservoirs

Monkeys and mosquitoes are the primary reservoirs in forested areas of Africa and South America. Humans and *Aedes aegypti* mosquitoes are involved in the infective cycle in urban areas.

D. Modes of Transmission

Yellow fever has two different transmission cycles that affect humans, the urban cycle and the jungle cycle. In the urban cycle, the virus is transmitted among humans by the bite of an infected house-dwelling *Aedes aegypti* mosquito. Monkeys play little or no role as a reservoir. In the jungle cycle, several species of mosquitoes are vectors and transmit virus from monkey to monkey. Humans are involved in the jungle cycle accidentally if infected mosquitoes bite them. In South America, sporadic infection of humans occurs almost exclusively in forestry and agricultural workers through occupational exposure; however occasionally cases are described among tourists. Direct person-to-person spread of yellow fever does not occur.

E. Incubation Period

The incubation period for yellow fever is 3 to 6 days.

F. Period of Communicability or Infectious Period

Yellow fever is not transmitted from person-to-person. The blood of patients is infective for mosquitoes from shortly before onset of fever until 3 to 5 days of illness. The incubation period in *Aedes aegypti* mosquitoes is commonly 9 to 12 days at the usual tropical temperatures. Once infected, mosquitoes remain so for life.

G. Epidemiology

Yellow fever is now endemic to certain regions of South America and Africa only. Any cases in New Jersey are probably due to recent travel abroad.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. New Jersey Department of Health and Senior Services (NJDHSS) Case Definition

CASE CLASSIFICATION

A. CONFIRMED

A clinically compatible case, **AND**

- Demonstration of fourfold or greater rise in yellow fever antibody titer in a patient who has no history of recent yellow fever vaccination and cross-reactions to other flaviviruses have been excluded, **OR**
- Demonstration of yellow fever virus, antigen or genome in tissue, blood or other body fluid.

B. PROBABLE

A clinically compatible case, **AND**

- Demonstration of stable elevated antibody titer to yellow fever virus (equal or greater than 1:32 by complement fixation, 1:256 by immunofluorescence assay, 1:320 by hemagglutination inhibition, 1:160 by neutralization, or a positive serologic result by immunoglobulin M-capture enzyme immunoassay).

NOTE: Cross-reactive serologic reactions to other flaviviruses must be excluded, and the patient must not have a history of yellow fever vaccination.

C. POSSIBLE

Not used.

B. Laboratory Testing Services Available

The NJDHSS Public Health Environmental Laboratories (PHEL) do not provide testing for yellow fever virus. Arrangements can be made through PHEL for appropriate sample types to be sent to the Centers for Disease Control and Prevention (CDC) for diagnostic testing. Contact the PHEL at 609.984.2622 for more information

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify imported cases of yellow fever to understand the global epidemiology of endemic and epidemic yellow fever.
- To ensure that cases are appropriately contained to prevent the introduction of virus into native mosquito populations.
- To identify locally acquired cases, if they occur, so appropriate active surveillance and mosquito control interventions can be taken.
- To identify cases that may be part of a larger, worldwide outbreak.
- To provide travelers with appropriate preventive health information.

B. Laboratory and Healthcare Provider Reporting Requirements

The New Jersey Administrative Code (N.J.A.C.) 8:57-1.8 stipulates that the health care providers and laboratories report (by telephone, confidential fax, over the Internet using the Communicable Disease Reporting System [CDRS] or in writing) all cases of yellow fever to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located.

C. Health Officer's Reporting and Follow-Up Responsibilities

1. **Reporting Requirements**
   The N.J.A.C. 8:57-1.8 stipulates that each local health officer must report the occurrence of any case of yellow fever, as defined by the reporting criteria in Section 2 A above. Current requirements are that cases be reported to the NJDHSS IZDP using the CDS-1 form. A report can be filed electronically over the Internet using the confidential and secure CDRS.

2. **Case Investigation**
   a. It is the local health officer's responsibility to complete the CDS-1 form by interviewing the patient and others who may be able to provide pertinent information. Much of the information required on the form can be obtained from the patient's healthcare provider or the medical record.

   b. Use the following guidelines to complete the form:
      1) Accurately record the demographic information, treatment information, occupation, whether hospitalized (including location and associated dates), date of symptom onset, symptoms, laboratory information, treatment information, healthcare provider information, and outcome of disease (*e.g.*, recovered, died).
      2) Travel history: use the approximate incubation period range for yellow fever (3–6 days). Specifically, focus on the period beginning 3 days prior to the case's onset date back to approximately 6 days before onset for travel history; determine the date(s) and geographic area(s) traveled to by the case-patient.
      3) Complete the travel status section to indicate where yellow fever was acquired. If unsure, check "Unknown."
      4) Include information about the case-patient's yellow fever vaccination status, including the date most recently vaccinated.
      5) Include any additional comments regarding the case.
      6) If there have been several attempts to obtain patient information (*e.g.*, the patient or healthcare provider does not return your calls or respond to a letter, or the patient refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as you have gathered. Please note on the form the reason why it could not be filled out completely. **If CDRS is used to report, enter the collected information into the "Comments " section.**

   c. After completing the case report form, attach lab report(s) and mail in an envelope marked "Confidential" to the NJDHSS IZDP or the report can be filed electronically over the Internet using the CDRS. The mailing address is:

      NJDHSS
      Division of Epidemiology, Environmental and Occupational Health
      Infectious and Zoonotic Diseases Program
      P.O.Box 369
      Trenton, NJ 08625-0369

   d. Institution of disease control measures is an integral part of case investigations. It is the local health officer's responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4, "Controlling Further Spread."

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (N.J.A.C. 8:57-1.10)

Minimum Period of Isolation of Patient

Blood and body fluid precautions, and prevention of mosquitoes from biting the case for at least 5 days; see Section 4 B below.

Minimum Period of Quarantine of Contacts

No restrictions.

B. Protection of Contacts of a Case

It is important to prevent mosquitoes from biting a case-patient for at least 5 days after onset of illness. Mosquito control can be done by screening sickrooms, spraying with insect repellent and using bed nets. These measures can prevent transmission of yellow fever from infected mosquitoes to contacts of a case.

Note: The *Aedes aegypti* mosquito has been found in New Jersey but has not become established in the state. A potential vector of yellow fever, *Aedes albopictus*, has become established in New Jersey. Concerns over local transmission should be small, however.

C. Managing Special Situations

Locally Acquired Case

As noted above in Section 4 B, a locally acquired case of yellow fever would be an unusual occurrence as the *Ae. aegypti* mosquito has not become established in New Jersey. However, in recent years a resurgence of *Ae. aegypti* has occurred in South America and has increased the potential for reemerging urban yellow fever. In addition, an Asian mosquito, *Ae. albopictus*, has become established in many areas of North and South America and is considered to be a potential vector of yellow fever. If local health officer determine during the course of an investigation that a case-patient or suspect case-patient does not have a recent travel history to an endemic country, contact the NJDHSS IZDP at 609.588.7500 as soon as possible. Environmental measures such as investigating local areas visited by the case-patient to locate the focus of infection and surveillance of other people for illness may be necessary. State and county mosquito control agencies would need to conduct mosquito surveillance, and, if necessary, mosquito control immediately.

Reported Incidence Is Higher than Usual/Outbreak Suspected

If an outbreak is suspected, investigate to determine the source of infection and mode of transmission. A common exposure to or association with *Ae. aegypti* mosquitoes (*e.g.*, travelers returning from endemic countries) should be sought and applicable preventive or control measures should be instituted. Contact the IZDP at 609.588.7500 as soon as possible. The IZDP staff can help determine a course of action to prevent further cases and can perform surveillance for cases that may cross several jurisdictions and therefore be difficult to identify at a local level. The NJDHSS will also request that the affected jurisdictions' mosquito control agencies conduct the necessary mosquito surveillance.

D. Preventive Measures

International Travel and Vaccination

- A live attenuated vaccine is recommended for all individuals over 9 months old who will be living in or traveling to endemic areas and is required by international regulations for travel to and from certain countries. Pregnant women should not be vaccinated in the first trimester except if visiting high-risk areas.
- Without a valid certificate of immunization against yellow fever, many countries require a 6-day quarantine of travelers coming from or going to recognized yellow fever zones of Africa and South America.
- Travelers to yellow fever endemic countries are encouraged to protect themselves from mosquitoes by using repellents, wearing protective clothing and using mosquito nets when rooms are not screened. Unlike other vectors, the principal mosquito vectors of yellow fever bite during daytime hours.
- For more information regarding international travel and the yellow fever vaccine, contact the CDC's Traveler's Health Office at 877. 394.8747 or through the Internet at <http://www.cdc.gov/travel>.

ADDITIONAL INFORMATION

The CDC surveillance case definition for yellow fever is the same as the criteria outlined in Section 2 A of this chapter. CDC case definitions are used by the state health departments and CDC to maintain uniform standards for national reporting. For reporting to the NJDHSS, always refer to the criteria in Section 2 A.

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